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upon a famine in Russia to weaken the arm of the empire, they count without their host.

SERGIUS V.

### THE COMING GLACIAL AGE.

WHEN men are told that by far the stronger probability is that countless ages hence the solar system will be frozen to death than that it will be burned to death, their gaze is immediately turned groundward again. "After us the deluge," and that is long, long after the deluge.

Our pity for the woes of remote posterity is, if possible, feebler and more vague than that we feel for those who suffered in the remote past. The smallest members of the solar system, the moons, have already suffered glacial death. Can we shiver in sympathy with the last lunar equatorial inhabitants who may have held up their icy hands imploringly to the sun? As from cycle to cycle the sun shrinks more and more, and thus expends his vast stores of latent energy, planet after planet will succumb, we are told, until, last of all, the sun himself will go out in the blackness of darkness forever.

Forever? Then what will become of the enormous amount of expended energy? Speculative science has thus far offered no satisfactory answer to the question. The indestructibility of energy is a law of physics as well established as that of the indestructibility of matter. "Radiated into space" is no adequate explanation. Empty space, or, rather, the ethereal *plenum*, which is the only thinkable environment of masses of matter lighting and heating one another, held together by mutual gravitation, cannot retain within itself the smallest tremor of the energy it transmits, or else the most powerful telescope could never reveal to us the trembling ray that has been millions of years on its journey. The explanation that it is "dissipated and rendered unavailable in the form of heat"—in other words that all "strain and stress are relieved and equilibrium established"—is scarcely more satisfying. Its apparent fallacy may, perhaps, be made plain by a somewhat "violent" hypothesis. *Disce omnia ex uno.*

Let the whole universe be represented by two atoms, which we will suppose to be placed originally (say) one millimetre apart. Then the force of their mutual gravitation multiplied by one millimetre may represent the total potential energy of the universe at the beginning of the processes now going on. In obedience to their mutual attraction, they move toward one another with accelerating velocity. This motion may stand for all the phenomena which have occurred since the beginning; otherwise, for the conversion of the potential energy of the universe to kinetic energy. Finally, at their maximum velocity, the two atoms come into contact. This, of course, represents the period when the condensation of matter shall have reached its maximum, when all latent energy shall have been expended and "radiated into space." But will the two atoms remain in contact? No; by the inevitable law of dynamics they will rebound and return to their original positions, when the process will be repeated, and so on *ad infinitum*.

If two atoms would act thus, so would four atoms; so would millions. Why not the universe itself? What is the true meaning of the term "unavailable energy"? What would correspond to it in the position or movements of the pair of atoms supposed?

WALTER J. GRACE.